CRWMS/M&O

Design Analysis Cover Sheet

Complete only applicable items.

(1.)

WBS: 1.2.6 1/2

QA: QA 1/11 03/28/95

Page: 1 Of: 10

2. DESIGN ANALYSIS TITLE

MOL.19951031.0386

SITE LIGHTING FOUNDATIONS

3. DOCUMENT IDENTIFIER	4. REV. NO.	5. TOTAL PAGES
BABBDA000-01717-0200-00006 REV 00	00	10

6. TOTAL ATTACHMENTS/NO. OF PAGES IN EACH	7. SYSTEM ELEMENT
NONE	ESF

	Print Name	Signature	Date
8. Originator	M. Gomez		01/17/95
9. Checker	J. Salchak		01/18/95
10. Lead Discipline Engineer	M. Gomez		01/18/95
11. Department Manager	J. Salchak		01/18/95

12. REMARKS

CRWMS/M&O

Design Analysis Revision Record

Complete only applicable items.

(1.)

WBS: 1.2.6

QA: QA 03/28/95

2. DESIGN ANALYSIS TITLE			
SITE LIGHTING FOUNDATIONS			
3. DOCUMENT IDENTIFIER			4. REVISION NO.
BABBDA000-01717-0200-00006 REV 00			00
5. Revision No.	6. Pages Added	7. Pages Deleted	8. Description of Revision
00	10	0	Original Issue

1. PURPOSE

The purpose of this analysis is to design structural foundations for the Site Lighting. This analysis is in support of design drawing BABBDF000-01717-2100-23016.

2. QUALITY ASSURANCE

The items considered within this analysis relate to temporary equipment foundations not included on the Q-list. There are no Q-Controls associated with this analysis.

3. METHOD

The equipment foundation shall be designed in Section 10 using standard foundation design hand calculations. The vertical loads will reflect Electrical requirements. Lateral loads will be calculated using applicable codes. The soil bearing and foundation stresses will be analyzed using accepted engineering mechanics. The foundation will be designed using the Strength Design Method.

4. CODES AND STANDARDS

4.1 U.S. DEPARTMENT OF ENERGY (DOE):

DOE 6430.1A, dated April 6, 1989	General Design Criteria

4.2 AMERICAN CONCRETE INSTITUTE (ACI):

ACI 318-89	Building Code Requirements for Reinforced Concrete

4.3 AMERICAN NATIONAL STANDARDS INSTITUTE, INC./AMERICAN SOCIETY OF CIVIL ENGINEERS (ANSI/ASCE):

ANSI/ASCE 7-88	Minimum Design Loads for Buildings and Other Structures

4.4 UNIFORM BUILDING CODE (UBC):

UBC, 1991

4.5 AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC):

AISC, 9th Edition	Manual of Steel Construction, Allowable Stress Design

4.6 AMERICAN WELDING SOCIETY (AWS):

AWS D1.1-94	Structural Welding Code-Steel

5. DESIGN INPUTS

5.1 Exploratory Studies Facility (ESF) Basis for Design (BFD) Document, Package 1D, Section 7.2.4.1 Power System (BAB000000-01717-6300-00002, Rev. 05)

6. CRITERIA

6.1 The Exploratory Studies Facility Design Requirements (ESFDR) (YMP/CM-0019, Rev. 1)

6.2 ESF BFD Document, Package 1D (BAB000000-01717-6300-00002, Rev. 05)

6.3 Determination of Importance Evaluation for ESF North Portal Pad (BABB00000-01717-0200-00001, Rev. 04)

7. ASSUMPTIONS

None used.

8. REFERENCES

8.1 Concrete Reinforcing Steel Institute, Handbook (1978 Edition)

8.2 Geotechnical Recommendations for Design, North Ramp Surface Facility, Exploratory Studies Facility, Yucca Mountain Project, Nevada, SCP No. 8.3.1.14.2. (March 19, 1993)

9. COMPUTER PROGRAMS

None used.

10. DESIGN ANALYSIS

10.1 This analysis was initially performed under Revision 0, ICN 1 of the ESFDR, with Seismic Zone 4. Revision 0, ICN 2 of the ESFDR revised the lowered criteria to Seismic Zone 3. The initial design is conservative, with foundation sizes based on physical requirements. Therefore, the analysis will reflect the higher criteria of Zone 4.

10.2 Allowable Soil Pressure = 2,000 psf (See Reference 8.2)

10.3 Passive Soil Pressure = 350 psf per foot of depth (See Reference 8.2)

10.4 Concrete Properties

A. Compressive Strength (f'c) = 4,000 psi
B. Concrete weight = 150 pcf

10.5 Reinforcing Steel Yield Strength (fy) = 60 ksi

(Reference pages 6,7, 8, and 9 for hand calculations)

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SUBJECT: SITE LIGHTING FNDS

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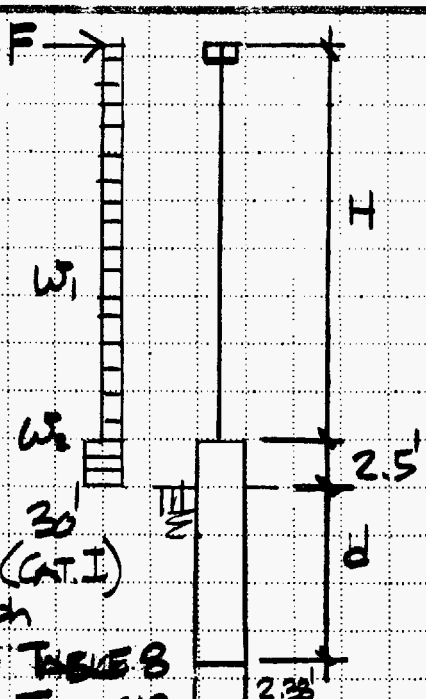
CHECKED BY:
CHECKED DATE:

10. DESIGN ANALYSIS (CONT'D)



10.6 30' POLE FDN: H = 30'

- LATERAL FORCES

A.) WIND

$F = q_{z2} G_h C_F A_F$ (ANSI/ASCE 7-88)

$q_{z2} = .00256 (K_z)(I V)^2$
$= 16.1$ psf

$K_z = .98$ @ 30'
$I = 1.0$ (CAT. I)
$V = 80$ mph
$G_h = 1.32$ TABLE 8
$C_F = 2.0$ TABLE 12
$h/D = 30/.75 = 40 > 25$

$F = 16.1(1.32)(2)(A_F)$
$= 42.5 A_F$

$W_1 = 7.5'(42.5) = 32\#/'$
$W_2 = 2.33'(42.5) = 100\#/'$
$F = 5'(1)(42.5) = 250\#$

$M_{@f} = 250\#(32.5) + \frac{32(32.5)^2}{2} + \frac{68(2.5)^2}{2} = 25{,}250\#'$

$F_{EQUIV} = \frac{25{,}250\#'}{32.5'} = 777\#$

B.) SEISMIC: SEE PAGE 9 OF 10

∴ FROM PAGE 9, WIND GOVERNS

- FOOTING DEPTH (d)

FROM UBC SECTION 2907 (g) 2
ASSUME TOP TO BE UNRESTRAINED (CONSERVATIVE)

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
Civilian Radioactive Waste Management System
Management & Operating Contractor

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CHECKED DATE:

$$d = \frac{A}{2}\left[1 + \sqrt{1 + \frac{4.36h}{A}}\right]$$

$$A = \frac{2.34P}{S_1 b}$$

P = 111#
b = 2.33'
h = 32.5'
S_1 = 350psf d/3

S_1 = ALLOWABLE SOIL BEARING PRESSURE @ d/3

d ASSUMED	S_1	A	d REQ'D	OK?
8'	933	.836	5.2'	Y
7'	817	.956	6.3'	Y
6'	700	1.115	6.9'	N

∴ USE 2'-4" ϕ x 7'-0" LONG

-REINFORCING

$M_U = 1.4(25.3^{K'}) = 35.4^{K'}$; $P_U = 10^K$ (CONSERV.)

FROM CRSI MANUAL w/ 5.#10 $M_U = 320^{K'}$ @ $P_U = 369^K$ OK

USE 2'-4" ϕ x 7'-0" LONG w/ 5.#10

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
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CHECKED BY:
CHECKED DATE:

10.7 40' POLE FDN $H = 40'$

- LATERAL FORCES: SIMILAR TO 10.1 EXCEPT $K_z = 1.06$

$q_p = 16.1 \left(\frac{1.06}{.98}\right) = 17.4$

$F = 42.5 \frac{17.4}{16.1} = 46 \text{ psf}$ AT

$w_1 = .75(46) = 34.5 \#/'$

$w_2 = 2.33'(46) = 110 \#/'$

$F = 5'(1)(46) = 250\#$

$M_{OT} = 250(42.5) + \frac{34.5(42.5)^2}{2} + \frac{75.5(2.5)^2}{2} = 42{,}020 \#'$

$F_{EQUIV} = \frac{42{,}020}{42.5} = 1000\#$

- FOOTING DEPTH (d)

SIMILAR TO SECTION 10.1

$d_{ASSUMED}$	S	A	$d_{REQ'D}$	OK?
10'	1167	.860	6.8	Y
9'	1050	.956	7.15	Y
8'	933	1.076	7.62	Y
7'	817	1.250	8.19	N

USE 2'-4" ϕ × 8'-0" LONG

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
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CHECKED DATE:

- REINFORCING

$M_U = 1.4(42) = 59^{FT}$

BY INSPECTION W/ SECTION 10.1, REINFORCING OK

USE 2'-4" ϕ x 8'-0" LONG
W/ 5-#10

- CONTINUATION FROM PAGE 6 OF 10

B.) SEISMIC: $V = \frac{ZIC}{R_W} W$ (UBC CHAPTER 23)

Z = .4 ZONE 4
I = 1.0
R_W = 5 TABLE 23Q (ITEM 11)
C = 2.75 MAX

$C/R_W = 2.75/5 = .55$ ← GOVERNS
= .50 MIN (Section 2338(d))

$V = .4(1)(.55)W = .22W$

$W = \underset{\text{POLE}}{200^{\#}} + \underset{\text{LIGHT}}{50^{\#}} = 250^{\#}$

$V = 250^{\#}(.22) = 55^{\#}$ ∴ WIND GOVERNS

11. CONCLUSIONS

11.1 The design shows that a concrete foundation that has minimum dimensions of 2'-4" diameter x 7'-0" long, reinforced with 5- #10's, is adequate to support a Site Lighting Standard with a nominal pole length of 30'.

11.2 The design shows that a concrete foundation that has minimum dimensions of 2'-4" diameter x 8'-0" long, reinforced with 5- #10's, is adequate to support a Site Lighting Standard with a nominal pole length of 40'.

12. ATTACHMENTS

None.